

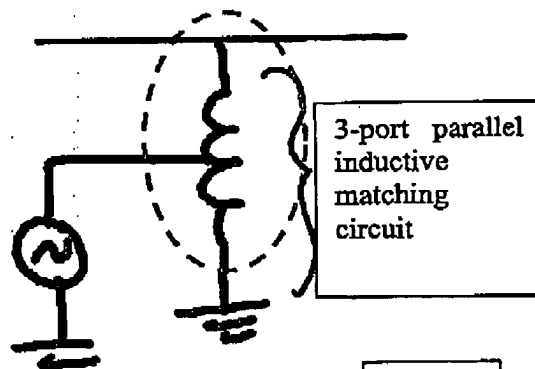
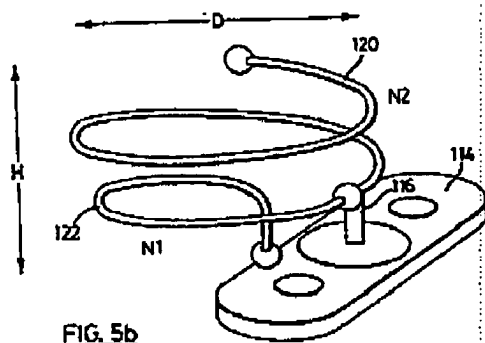
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FIG. 1

United States Patent

Suzsada et al.

Patent Number: 5,986,614

Date of Patent: Nov. 16, 1999

[54] ANTENNA DEVICES

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[21] Appl. No.: 09/024,401

[22] Filed: Feb. 18, 1998

[50] Foreign Application Priority Data

Feb. 24, 1997 JP1- Japan 9439157

[51] Int. Cl.⁶ H01Q 9/00; H01Q 1/38

[52] U.S. Cl. 343/702; 343/706; 343/707

[58] Field of Search 343/702, 706, 707, 708, 709, 710, 711, 712, 713, 714, 715, 716, 717, 718, 719, 720, 721, 722, 723, 724, 725, 726, 727, 728, 729, 730, 731, 732, 733, 734, 735, 736, 737, 738, 739, 740, 741, 742, 743, 744, 745, 746, 747, 748, 749, 750, 751, 752, 753, 754, 755, 756, 757, 758, 759, 760, 761, 762, 763, 764, 765, 766, 767, 768, 769, 770, 771, 772, 773, 774, 775, 776, 777, 778, 779, 780, 781, 782, 783, 784, 785, 786, 787, 788, 789, 790, 791, 792, 793, 794, 795, 796, 797, 798, 799, 800, 801, 802, 803, 804, 805, 806, 807, 808, 809, 810, 811, 812, 813, 814, 815, 816, 817, 818, 819, 820, 821, 822, 823, 824, 825, 826, 827, 828, 829, 830, 831, 832, 833, 834, 835, 836, 837, 838, 839, 840, 841, 842, 843, 844, 845, 846, 847, 848, 849, 850, 851, 852, 853, 854, 855, 856, 857, 858, 859, 860, 861, 862, 863, 864, 865, 866, 867, 868, 869, 870, 871, 872, 873, 874, 875, 876, 877, 878, 879, 880, 881, 882, 883, 884, 885, 886, 887, 888, 889, 890, 891, 892, 893, 894, 895, 896, 897, 898, 899, 900, 901, 902, 903, 904, 905, 906, 907, 908, 909, 910, 911, 912, 913, 914, 915, 916, 917, 918, 919, 920, 921, 922, 923, 924, 925, 926, 927, 928, 929, 930, 931, 932, 933, 934, 935, 936, 937, 938, 939, 940, 941, 942, 943, 944, 945, 946, 947, 948, 949, 950, 951, 952, 953, 954, 955, 956, 957, 958, 959, 960, 961, 962, 963, 964, 965, 966, 967, 968, 969, 970, 971, 972, 973, 974, 975, 976, 977, 978, 979, 980, 981, 982, 983, 984, 985, 986, 987, 988, 989, 990, 991, 992, 993, 994, 995, 996, 997, 998, 999, 1000

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Assistant Examiner: Shuichi Chen
Attorney Agent, or Firm: Oshikawa, Rhee, Cho & Sohma, LLP

[57] ABSTRACT

The invention provides a compact and light-weight antenna device for use in a mobile telephone requiring a wide frequency band. An antenna device 10 includes a first printed circuit board 11 and a ground plate 12 generally arranged in parallel, and a second printed circuit board 13 arranged vertically between the first printed circuit board 11 and the ground plate 12, and an antenna body 14 mounted on the second printed circuit board 13. A capacitive load conductor 15 is mounted on the first printed circuit board 11, and a surface electrode 16, a ground electrode 17 and a transmission line 18 are mounted on the second printed circuit board 13. The antenna body 14 is provided with terminals 19 and 21 connected to both ends of a conductor (not shown).

8 Claims, 3 Drawing Sheets

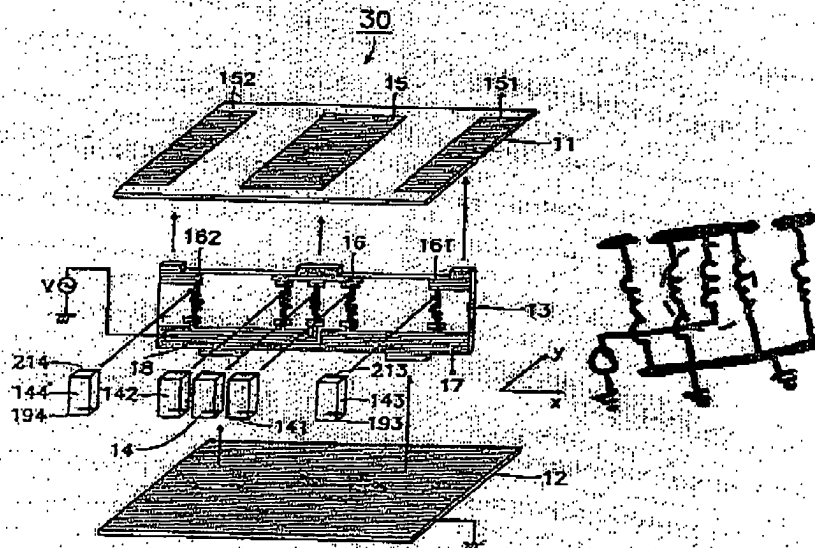


FIG. 2

United States Patent (19)**Wolpezzank****(11) Patent Number: 4,912,482****(45) Date of Patent: Mar. 27, 1990****(54) ANTENNA****(72) Inventor: Edmund W. Wolpezzank,
Chesham, United Kingdom****(73) Assignee: The General Electric Company, p.l.c.,
London, United Kingdom****(21) Appl. No.: 75,969****(22) Filed: Jul. 21, 1987****(30) Foreign Application Priority Data**

Jul. 24, 1986 (GB) United Kingdom 250,806

(51) Int. Cl.: H01Q 1/52**(52) U.S. Cl.:** 343/704; 343/710; 343/721**(53) Field of Search:** 343/704, 705, 710, 721, 724, 343/703, 693, 723, 727, 728**(54) References Cited****U.S. PATENT DOCUMENTS**2,435,412 12/1948 Brown
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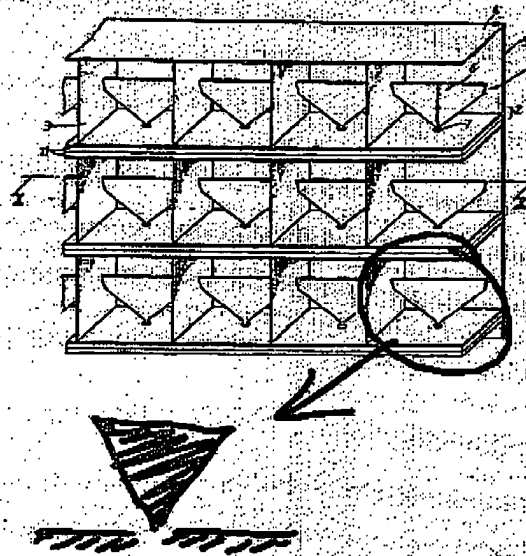
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Primary Examiner: Neil Ellis
Attorney: Kitcher, Houghton & Co.
Attorney: Apple, or Firm: Simpson & Frank**(57) ABSTRACT**

An antenna includes an array of electrically conductive cells each having one open side and comprising a reflecting/receiving element. The conductive cells achieve mutual coupling between elements.

14 Claims, 3 Drawing Sheets**FIG. 3**

United States Patent**Patent****(1) Patent Number: 4,896,162****(2) Date of Patent: Jan. 23, 1990****(3) CAPACITANCE LOADED MONOPOLE ANTENNA****(7) Inventor: G. D. Pashan, La Habra, Calif.****(8) Assignor: Hughes Aircraft Company, Los Angeles, Calif.****(21) Appl. No.: 25,228****(22) Filed: Mar. 14, 1987****(51) Int. Cl.: H01Q 1/36; H01Q 9/36****(52) U.S. Cl.: 343/740; 343/766****(53) Field of Search: 343/740; 343/766; 343/768****(54) References Cited****U.S. PATENT DOCUMENTS**

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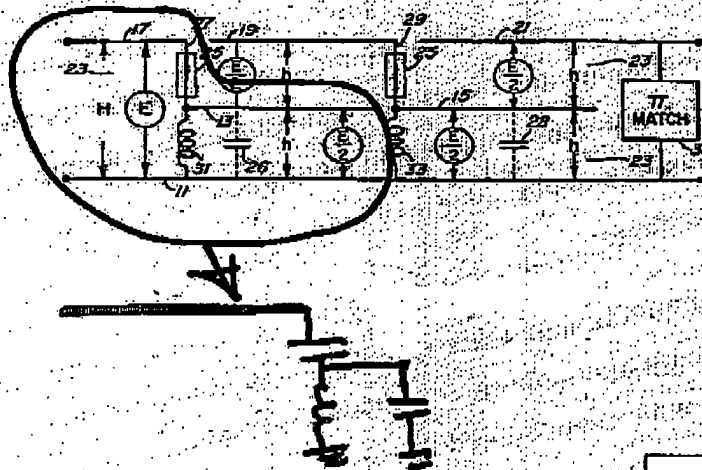
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Primary Examiner: Joseph E. Chiswick, Jr.
Assistant Examiner: Michael C. Winter
Attorney Agent or Firm: Woods K. Dawson-Lee

(57) ABSTRACT

An antenna employing a first capacitor formed by a conductive element disposed above a ground plane and vertically extended adjacent capacitors formed over the ground plane. The adjacent capacitors are connected to the ground plane by tuned circuits resulting in additive coupling of the E fields across the first and adjacent capacitors and the prevention of E field shunting.

25 Claims, 3 Drawing Sheets

**FIG. 4**